PXI

NI PXI-1033 User Manual

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About This Manual

The *NI PXI-1033 User Manual* contains information about installing, configuring, using, and maintaining the NI PXI-1033 chassis.

Conventions

The following conventions are used in this manual:

» The **»** symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options** directs you to pull down the **File** menu, select the **Page Setup** item, and select **Options** from the last dialog box.

This icon denotes a note, which alerts you to important information.

This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash. When this symbol is marked on the product, refer to the *Read Me First: Safety and Radio-Frequency Interference* document, shipped with the product, for precautions to take.

bold Bold text denotes items that you must select or click in the software, such as menu items and dialog box options. Bold text also denotes parameter names.

italic Italic text denotes variables, emphasis, a cross-reference, a hardware label, or an introduction to a key concept. Italic text also denotes text that is a placeholder for a word or value that you must supply.

`monospace` Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames, and extensions.

Related Documentation

The following documents contain information that you might find helpful as you read this manual:

- *CompactPCI Specification PICMG 2.0 R 3.0*
- *PXI Hardware Specification*
- *PXI Software Specification*
- IEEE 1101.1-1991, *IEEE Standard for Mechanical Core Specifications for Microcomputers Using IEC 603-2 Connectors*
- IEEE 1101.10, *IEEE Standard for Additional Mechanical Specifications for Microcomputers Using IEEE 1101.1 Equipment Practice*

1

Getting Started

This chapter describes the key features of the NI PXI-1033 chassis, and lists the kit contents and optional equipment you can order from National Instruments.

Unpacking

Carefully inspect the shipping container and the chassis for damage. Check for visible damage to the metal work. Check to make sure all handles, hardware, and switches are undamaged. Inspect the inner chassis for any possible damage, debris, or detached components. If damage appears to have been caused during shipment, file a claim with the carrier. Retain the packing material for possible inspection and/or reshipment.

What You Need to Get Started

- ❑ NI PXI-1033 chassis
- ❑ Filler panels
- ❑ AC power cable—refer to Table 1-1 for AC power cables
- ❑ *NI PXI-1033 User Manual*
- ❑ *Read Me First: Safety and Radio-Frequency Interference*
- ❑ Driver CD-ROM containing NI PXI chassis software
- ❑ Chassis number labels
- ❑ MXI-Express x1 cable
- ❑ MXI-Express x1 host controller card

Table 1-1. AC Power Cables

Power Cable	Reference Standards
Standard 120 V (USA)	NEMA 5-15
Switzerland 220 V	SEV
Australia 240 V	AS C112
Universal Euro 230 V	CEE (7), II, IV, VII IEC83
North America 240 V	NEMA 6-15
United Kingdom 230 V	BS 1363/IEC83
Japan 100 V	JIS C8303

If you are missing any of the items listed in Table 1-1, or if you have the incorrect AC power cable, contact National Instruments.

Key Features

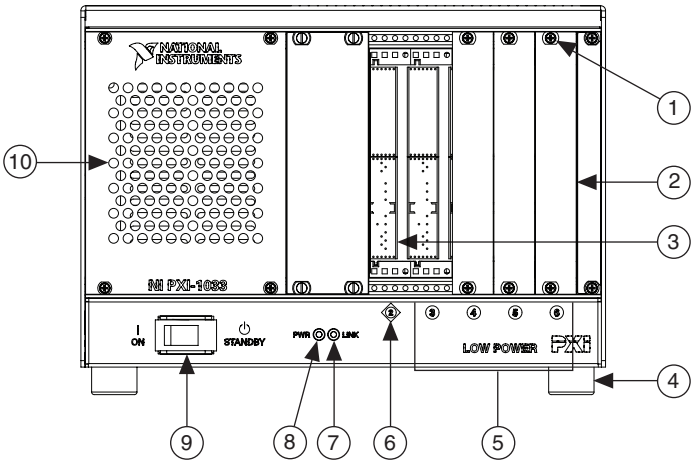
The NI PXI-1033 combines a 5-slot PXI backplane with a structural design that has been optimized for maximum usability in a wide range of applications.

The key features of the chassis include the following:

- Accepts 3U PXI and CompactPCI (PICMG 2.0 R 3.0) modules
- 5 peripheral slots in a rugged, compact chassis with universal AC input, and automatic voltage/frequency ranging
- Integrated MXI-Express controller
- On/Off (Standby) power switch on the front panel for easy access
- AUTO/HIGH temperature-controlled fan speed based on air-intake temperature to minimize audible noise
- Carrying handle for portability (Optional)
- Rack mountable

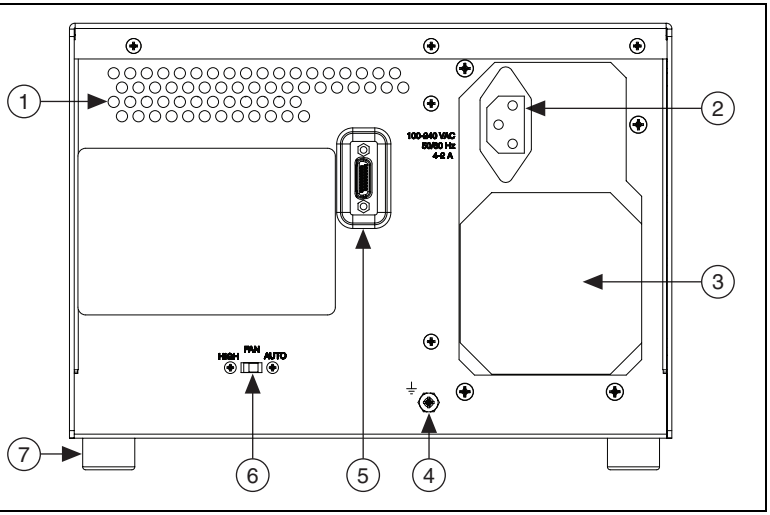
Chassis Description

Figure 1-1 and Figure 1-2 show the key features of the NI PXI-1033 chassis front and rear panels. Figure 1-1 shows the front view of the NI PXI-1033. Figure 1-2 shows the rear view of the NI PXI-1033. Figure 1-3 shows the bottom of the chassis.



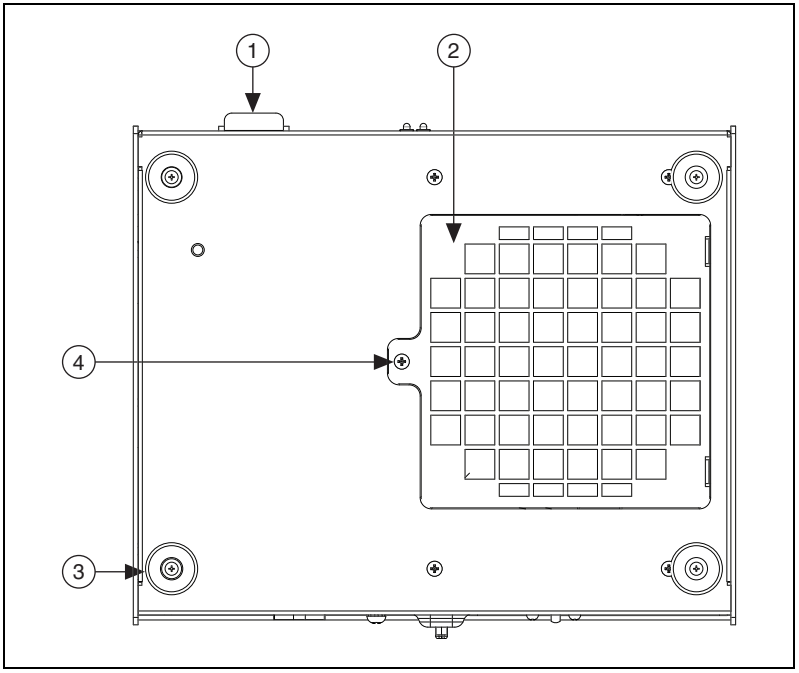
1	Captive Screw	6	Star Trigger/Peripheral Slot
2	PXI Filler Panel	7	Link LED
3	PXI Backplane	8	Power LED
4	Rubber Foot	9	Power Switch (Standby)
5	Generic Peripheral Slots	10	Power Supply Airflow Intake Vents

Figure 1-1. Front View of the NI PXI-1033 Chassis



1	Rear Exhaust Vents	5	NI MXI-Express Chassis Controller Connector
2	AC Input		
3	Power Supply Fan Exhaust	6	AUTO/HIGH Fan Speed Selector Switch
4	Chassis Ground Screw	7	Rubber Foot

Figure 1-2. Rear View of the NI PXI-1033 Chassis



1	Power Switch (Standby)	3	Rubber Foot
2	Air Filter Cover	4	Air Filter Cover Screw

Figure 1-3. Bottom View of the NI PXI-1033 Chassis

Optional Equipment

Contact National Instruments to order the following options for the NI PXI-1033 chassis.

EMC Filler Panels

Optional EMC filler panel kits are available from National Instruments.

Rack Mount Kit

A rack mount kit option is available for mounting the NI PXI-1033 chassis into a 19 in. instrument cabinet.

Handle/Feet Kit

An optional side handle and rubber feet kit is available from National Instruments to provide a handle for portability.

PXI-1033 Backplane Overview

Interoperability with CompactPCI

The PXI-1033 backplane is interoperable with 5 V and universal PXI-compatible products and standard CompactPCI products. This is an important feature, because some PXI systems may require components that do not implement PXI-specific features. For example, you may want to use a standard CompactPCI network interface card in a PXI chassis.

The signals on the backplane P1 connectors meet the requirements of the CompactPCI specification for both peripheral and system modules. Refer to Appendix B, *Pinouts*, for pinout information.

The PXI-specific signals are on the backplane P2 connectors and are found only on those signal lines reserved or not used in the CompactPCI 64-bit specification. Therefore, all modules that meet the requirements of the CompactPCI 64-bit specification will function in the PXI-1033. Refer to Appendix B, *Pinouts*, for pinout information.

Note The PXI-1033 backplane is 32-bit PCI. 64-bit CompactPCI cards will operate in 32-bit mode in this chassis.

The chassis backplane has +5 V V(I/O). Refer to the *CompactPCI Specification PICMG 2.0 R 3.0* for details regarding V(I/O).

MXI Interface

The NI PXI-1033 chassis has a built-in x1 MXI-Express interface that can be accessed through the MXI-Express chassis controller connector on the back of the chassis, as shown in Figure 1-2.

The MXI interface can be cabled to a remote system with a host card using a x1 MXI-Express cable to provide control of the NI PXI-1033 chassis.

Star Trigger Slot

The star trigger (ST) slot is slot 2. This slot has dedicated equal-length trigger lines between slot 2 and peripheral slots 3 through 6 (refer to Figure 1-4). Slot 2 is intended for modules with ST functionality that can provide individual triggers to all other peripheral modules. However, if you do not require advanced trigger functionality, you can install any standard peripheral module in this slot.

The star trigger slot can also be used to provide a PXI_CLK10 signal to the backplane. For more information regarding PXI_CLK10, refer to the *System Reference Clock* section.

Peripheral Slots

There are five peripheral slots, including the star trigger slot.

Local Bus

The PXI backplane local bus is a daisy-chained bus that connects each peripheral slot with adjacent peripheral slots to the left and right (refer to Figure 1-4). For example, the right local bus of slot 2 connects to the left local bus of slot 3, and so on.

The left local bus signal lines on slot 2 are used for star trigger. The right local bus signal lines on slot 6 are not routed anywhere.

Each local bus is 13 lines wide and can pass analog signals up to 42 V between cards or provide a high-speed TTL side-band digital communication path that does not reduce the PXI bus bandwidth.

Initialization software uses the configuration information specific to adjacent peripheral modules to evaluate local bus compatibility.

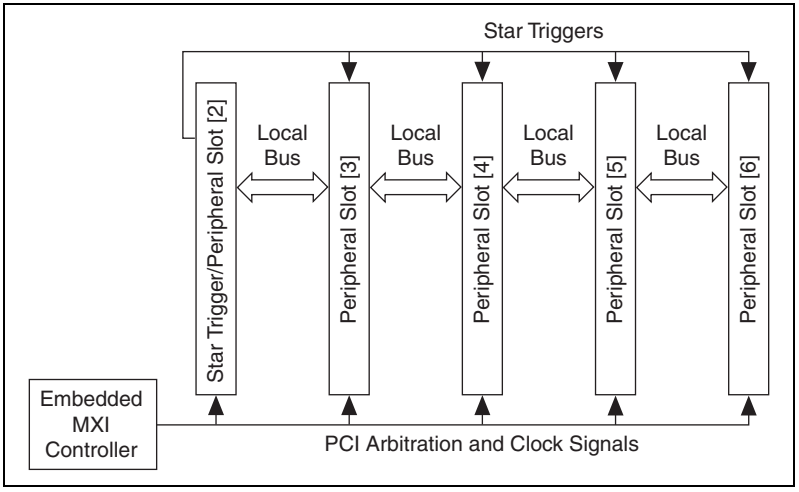


Figure 1-4. PXI Star Trigger and Local Bus Routing

Trigger Bus

All slots share eight PXI trigger lines. You can use these trigger lines in a variety of ways. For example, you can use triggers to synchronize the operation of several different PXI peripheral modules. In other applications, one module located in slot 2 can control carefully timed sequences of operations performed on other modules in the system. Modules can pass triggers to one another, allowing precisely timed responses to asynchronous external events the system is monitoring or controlling.

System Reference Clock

The PXI-1033 supplies the PXI 10 MHz system clock signal (PXI_CLK10) independently to each peripheral slot. An independent buffer (having a source impedance matched to the backplane and a skew of less than 250 ps between slots) drives the clock signal to each peripheral slot. You can use this common reference clock signal to synchronize multiple modules in a measurement or control system. You can drive PXI_CLK10 from an external source through the PXI_CLK10_IN pin on the P2 connector of the star trigger slot. Refer to Table B-2, *P2 (J2) Connector Pinout for the Star Trigger Slot*. You must manually switch S1 on the chassis backplane to enable or disable routing an external clock to peripheral slots.

2

Installation and Configuration

This chapter describes how to install, configure, and use the PXI-1033 chassis.

Before connecting the chassis to a power source, read this chapter and the *Read Me First: Safety and Radio-Frequency Interference* document included with your chassis.

Safety Information

Caution Before undertaking any troubleshooting, maintenance, or exploratory procedure, carefully read the following caution notices.

This equipment contains voltage hazardous to human life and safety, and is capable of inflicting personal injury.

- **Chassis Grounding**—The chassis requires a connection from the premise wire safety ground to the chassis ground. The earth safety ground must be connected during use of this equipment to minimize shock hazards. Refer to the *Connecting Safety Ground* section for instructions on connecting safety ground.
- **Live Circuits**—Operating personnel and service personnel *must not* remove protective covers when operating or servicing the chassis. Adjustments and service to internal components must be undertaken by qualified service technicians. During service of this product, the mains connector to the premise wiring must be disconnected. Dangerous voltages may be present under certain conditions; use extreme caution.
- **Explosive Atmosphere**—Do *not* operate the chassis in conditions where flammable gases are present. Under such conditions, this equipment is unsafe and may ignite the gases or gas fumes.

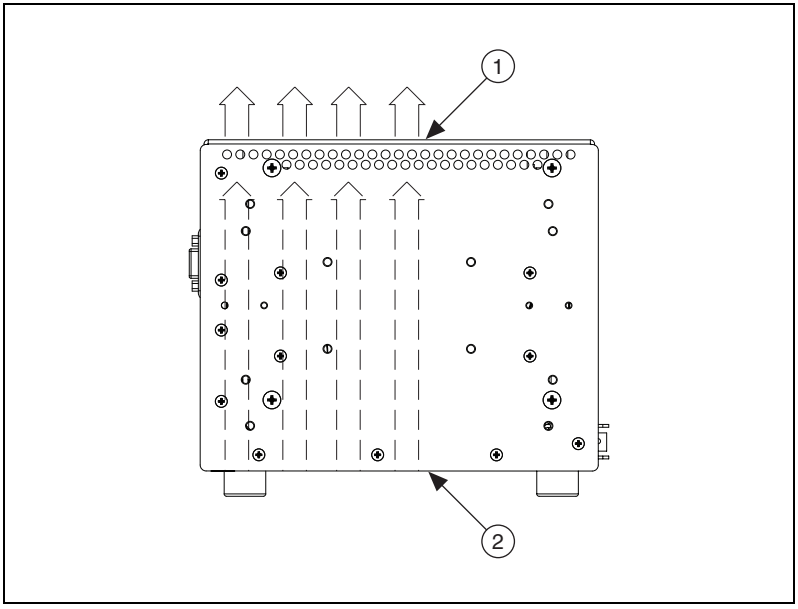
- **Part Replacement**—Only service this equipment with parts that are exact replacements, both electrically and mechanically. Contact National Instruments for replacement part information. Installation of parts with those that are not direct replacements may cause harm to personnel operating the chassis. Furthermore, damage or fire may occur if replacement parts are unsuitable.
- **Modification**—Do *not* modify any part of the chassis from its original condition. Unsuitable modifications may result in safety hazards.

Chassis Cooling Considerations

The chassis is designed to operate on a bench or in an instrument rack. Determine how you want to use the chassis and follow the appropriate installation instructions.

Providing Adequate Clearance

Apertures in the top, bottom, front, rear, and along the right side of the chassis facilitate power supply and module cooling. Air enters through filters and fan inlet in the bottom of the chassis for module cooling. It then exits through the upper sections at the right side, back, and through the top, as shown in Figure 2-1. Air cooling the power supply enters the front of the chassis, which is shown in Figure 1-1, *Front View of the NI PXI-1033 Chassis*, then exits through the rear of the chassis, which is shown in Figure 1-2, *Rear View of the NI PXI-1033 Chassis*. Place the chassis on a bench top or in an instrument rack so that the fans (air inlets) and the air outlet apertures along the right side, the top, and the back of the chassis have adequate ventilation. Provide at least 44.5 mm (1.75 in.) clearance above, behind, and on the sides of the unit for adequate venting. High-power applications may require additional clearance.



1	Air Outlets	2	Air Intake

Figure 2-1. NI PXI-1033 Module Cooling Airflow Side View

Install the chassis so that you can easily access the bottom panel. This simplifies replacing the air filters, if necessary.

Setting Fan Speed

The AUTO/HIGH fan-speed selector switch is on the rear panel of the NI PXI-1033. Refer to Figure 1-2, *Rear View of the NI PXI-1033 Chassis* to locate the fan-speed selector switch. Select HIGH for maximum cooling performance (recommended) or AUTO for quieter operation. The fan speed is determined by chassis intake air temperature when set to AUTO.

Installing Filler Panels

To improve module cooling performance, install filler panels (provided with the chassis) in unused or empty slots. Secure with the captive mounting screws provided.

Rack Mounting

Rack mount applications require the optional rack mount kits available from National Instruments. Refer to Figure A-3, *PXI-1033 Rack Mount Kit Components*, and the instructions supplied with the rack mount kits to install your chassis in an instrument rack.

Note You may want to remove the feet from the chassis when rack mounting. To do so, remove the screws holding the feet in place.

Connecting Safety Ground

Caution The NI PXI-1033 chassis is designed with a three-position inlet that connects the cord set ground line to the chassis ground. To minimize shock hazard, make sure the electrical power outlet you use to power the chassis has an appropriate earth safety ground.

Connecting to Power Source

Cautions Do *not* install modules prior to performing the following power-on test.

To completely remove power, you *must* disconnect the power cable.

Attach input power through the rear AC inlet using the appropriate AC power cable supplied. Refer to Figure 1-2, *Rear View of the NI PXI-1033 Chassis* to locate the AC inlet.

The power switch allows you to power on the chassis or place it in standby mode. Press the power switch to the On position (if not already on). Observe that all fans become operational.

Getting Started With The System

To set up and use your MXI-Express cards, you need the following:

- ❑ One NI MXI-Express x1 host card (PCIe or ExpressCard) and one NI PXI-1033
- ❑ A MXI-Express x1 cable
- ❑ A host PC with an available x1 (or wider) PCI Express slot or a laptop with an available ExpressCard slot

Unpacking The MXI-Express Host Card

Your MXI-Express card is shipped in antistatic packages to prevent electrostatic damage (ESD) to the devices. ESD can damage several components on the device.

Caution *Never* touch the exposed pins of connectors. Doing so may damage the device.

To avoid such damage in handling the device, take the following precautions:

- Ground yourself using a grounding strap or by holding a grounded object.
- Touch the antistatic package to a metal part of the computer chassis before removing the device from the package.

Remove the device from the package and inspect the device for loose components or any sign of damage. Notify NI if the device appears damaged in any way. Do *not* install a damaged device into the computer or PXI/CompactPCI chassis.

Store the device in the antistatic envelope when not in use.

Hardware Installation

The following are general instructions for installing the MXI-Express card. Consult your computer user manual or technical reference manual for specific instructions and warnings.

Note The software for your MXI-Express kit is included with the current NI driver CD, and is installed with the PXI platform software included as part of NI-VISA and other NI driver software products.

Installing an NI ExpressCard Module

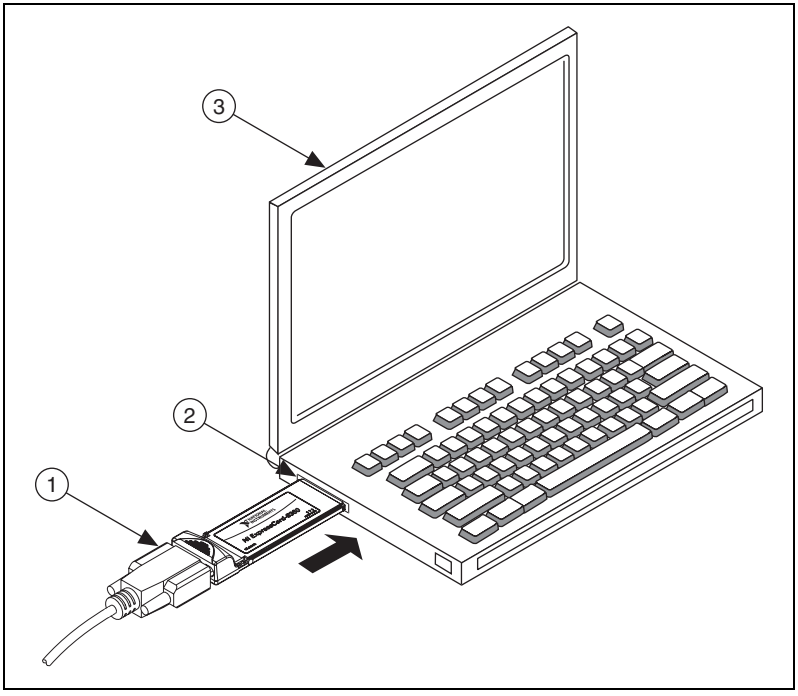
Because a laptop is not grounded, follow this procedure to safely connect it to your PXI system:

1. Install the NI ExpressCard module as directed in the previous section.
2. Touch the NI ExpressCard module and a metal part of the PXI chassis simultaneously.

3. Connect the cable to the NI ExpressCard module and the NI PXI-1033 chassis.
4. Plug the NI ExpressCard module into an available ExpressCard slot.

If your computer is already running (or hibernating) when you install NI ExpressCard module, you must reboot to detect the PXI system. Otherwise, the PXI system is detected when you start your computer.

Figure 2-2 shows how to insert the NI ExpressCard module and connect the cable.



1	MXI-Express Cable	2	ExpressCard Slot	3	Portable Computer

Figure 2-2. Installing the NI ExpressCard Module

Installing an NI PCIe Host Card

The following steps detail the process of installing an NI PCIe host card. Refer to Figure 2-3 to assist you in completing this procedure.

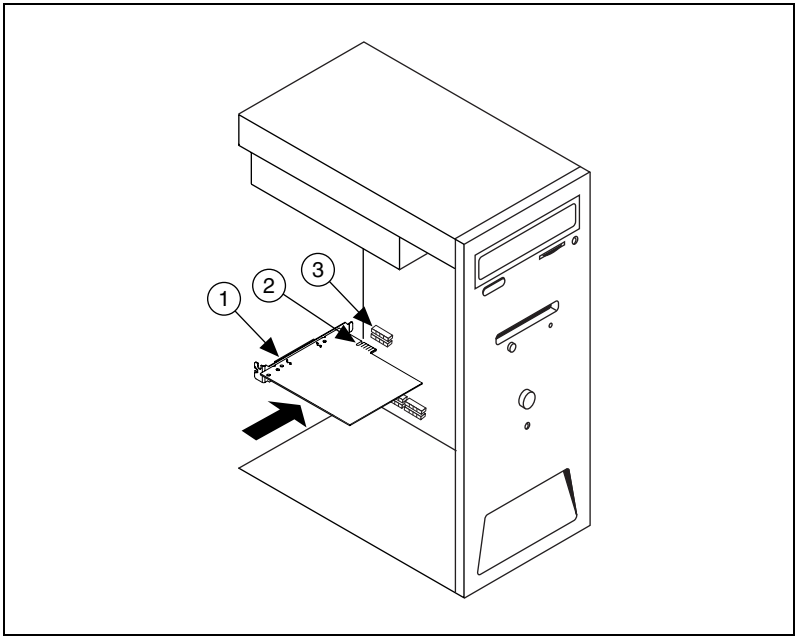
1. Power off your computer, but leave it plugged in while installing the NI PCIe host card. The power cord grounds the chassis and protects it from electrical damage while you install the card.

Caution To protect both yourself and the computer from electrical hazards, your computer should remain off until you finish installing the NI PCIe host card.

2. Remove the top cover or access port to the PCI Express bus.
3. Select any available PCI Express expansion slot (x1 or wider).

Note The BIOS or motherboard may not support the NI PCIe host card in a slot intended for a graphics card.

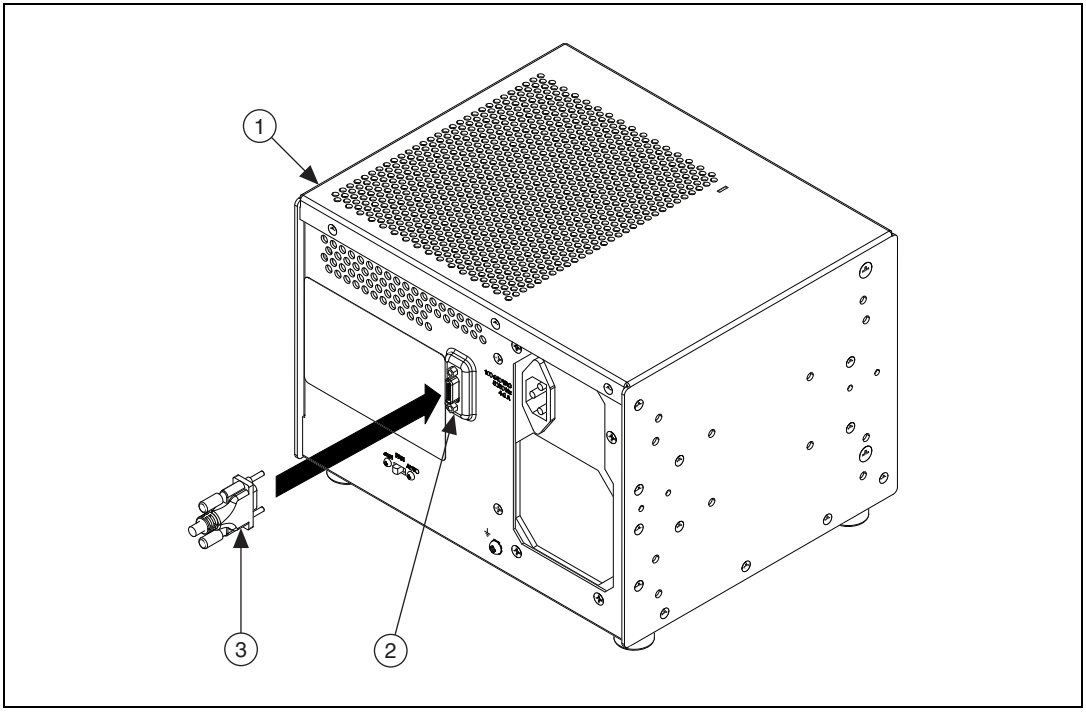
4. Locate the metal bracket that covers the cut-out in the back panel of the computer for the slot you have selected. Remove and save the bracket-retaining screw and the bracket cover.
5. Touch the metal part of the power supply case inside the computer to discharge any static electricity that might be on your clothes or body.
6. Line up the NI PCIe host card with the slot on the back panel. Slowly push down on the top of the NI PCIe host card until its card-edge connector is resting on the expansion slot receptacle. Using slow, evenly distributed pressure, press the NI PCIe host card straight down until it seats in the expansion slot.
7. Reinstall the bracket-retaining screw to secure the NI PCIe host card to the back panel rail.
8. Replace the computer cover.



1	NI PCIe host card	3	PCI Express Slot
2	PCI Express x1 Card-Edge Connector		

Figure 2-3. Installing the NI PCIe host card

Figure 2-4 shows the cable connection with which a PCIe host card controls the NI PXI-1033 chassis.



1 NI PXI-1033 chassis	3 MXI-Express cable connector
2 NI MXI-Express chassis controller connector	

Figure 2-4. NI PCIe Host Card Cable Connection

Cabling

1. Connect the appropriate MXI-Express cable to the NI PCIe card and NI PXI-1033 chassis. The cables have no polarity, so either end may be connected to either connector.

Caution Do *not* remove the cable after the system is powered on. Doing so can hang or cause errors in applications communicating with devices behind MXI-Express. If a cable becomes unplugged, plug it back into the system.

Note For more information about cables, refer to the *MXI-Express Cable Options* section of this chapter.

Powering Up the MXI-Express System

1. Power on the chassis.
2. Power on the host.

Typical PCI-PCI bridges are used to add PCI devices to a PCI hierarchy in which all the bridges and devices are contained within a single chassis. Because of this, BIOSes and operating systems make the assumption that all PCI devices in the entire hierarchy will be available as soon as code execution begins at power-up time. This assumption means that all of the expansion chassis must be turned on before the host PC for the BIOS and OS to correctly configure a MXI-Express system.

Notes You may add additional chassis using MXI-3 or MXI-4. When using MXI-4, there are no restrictions on chassis power-on order, except that the host must be powered on last. When using MXI-3, you must power up the chassis in order, beginning furthest from the host and ending with the host. Refer to the MXI-3 or MXI-4 documentation for further details.

The NI PXI-1033 chassis will assert a wake signal on power up. The host PC also will power on if it supports this functionality.

Powering Down the MXI-Express System

Because operating systems and drivers commonly make the assumption that PCI devices will be present in the system from power-up to power-down, it is important not to power off the expansion chassis until after the host PC is powered off. Powering off the expansion chassis while the host is still on can cause crashes or hangs. The order in which expansion chassis are powered off, relative to each other, is not important.

Checking LEDs for Status

After powering on the NI PXI-1033 chassis you should check the LEDs for status to ensure that all connected systems have linked. The following table defines the LED states.

Table 2-1. LED Status for the NI PXI-1033 Chassis

LED	Color	Meaning
PWR	Off	No power
	Green	Power is within spec
	Red	Power is out of spec
LINK	Off	Link not established
	Green	Link established
	Alternating Green and Red	Link established and activity present on the PCI bus
	Red	Link corrupted due to MXI sideband signals
	Blinking Red	Link corrupted due to missing PCIe Reference Clock

Functional Overview

MXI-Express is based on PCI Express technology. A MXI-Express kit uses a PCI Express switch and PCI Express-to-PCI bridge to enable control of a PXI or CompactPCI chassis from a PC with an available PCI Express slot. The PCI Express-to-PCI bridge architecture is transparent to device drivers, so no additional software is needed to support using PXI and CompactPCI devices in a chassis connected using MXI-Express.

The link between the PC and the chassis is a x1 cabled PCI Express link. This link is a dual-simplex communication channel comprised of a low-voltage, differentially driven signal pair. The link can transmit at a rate of 2.5 Gbps in each direction simultaneously.

MXI-Express Cable Options

MXI-Express is available with cables of various lengths. Table 2-2 shows the cables available from National Instruments.

Table 2-2. National Instruments MXI-Express Cables

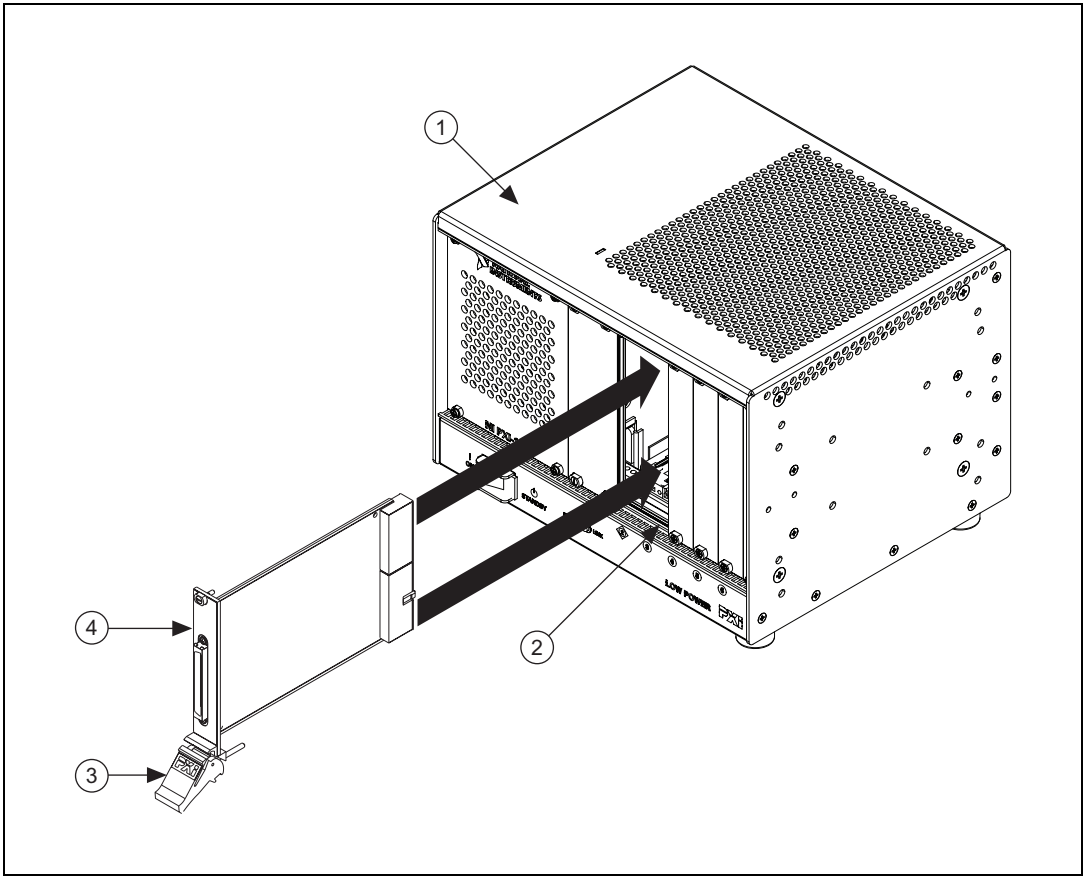
Cable Length (Meters)	Description
1 m	MXI-Express copper cable
3 m	MXI-Express copper cable
7 m	MXI-Express copper cable

Installing PXI Modules

Complete the following steps to install a module.

1. Make sure the power switch is in the Off (Standby) position.
2. Install a module into a chassis slot by first placing the module card edges into the front module guides (top and bottom), as shown in Figure 2-5. Slide the module to the rear of the chassis, making sure that the injector/ejector handle is pushed down as shown in Figure 2-5.
3. When you begin to feel resistance, push up on the injector/ejector handle to fully inject the module into the chassis frame. Secure the module front panel to the chassis using the module front-panel mounting screws.

Note You must install the driver software provided on the NI Driver CD supplied with your kit before you can use the modules in the chassis.



1	NI PXI-1033 Chassis	3	Injector/Ejector Handle
2	Injector/Ejector Rail	4	PXI Module

Figure 2-5. Installing PXI or CompactPCI Modules

PXI System Configuration with MAX

Configuration of the PXI system is handled through Measurement & Automation Explorer (MAX), included on the NI Driver CD-ROM packaged with your kit. MAX creates the `pxisys.ini` file that defines the layout and parameters of your PXI system. After installing the software on the NI Driver CD-ROM, the MAX icon will be present on the desktop. The configuration steps for single or multiple chassis systems are the same.

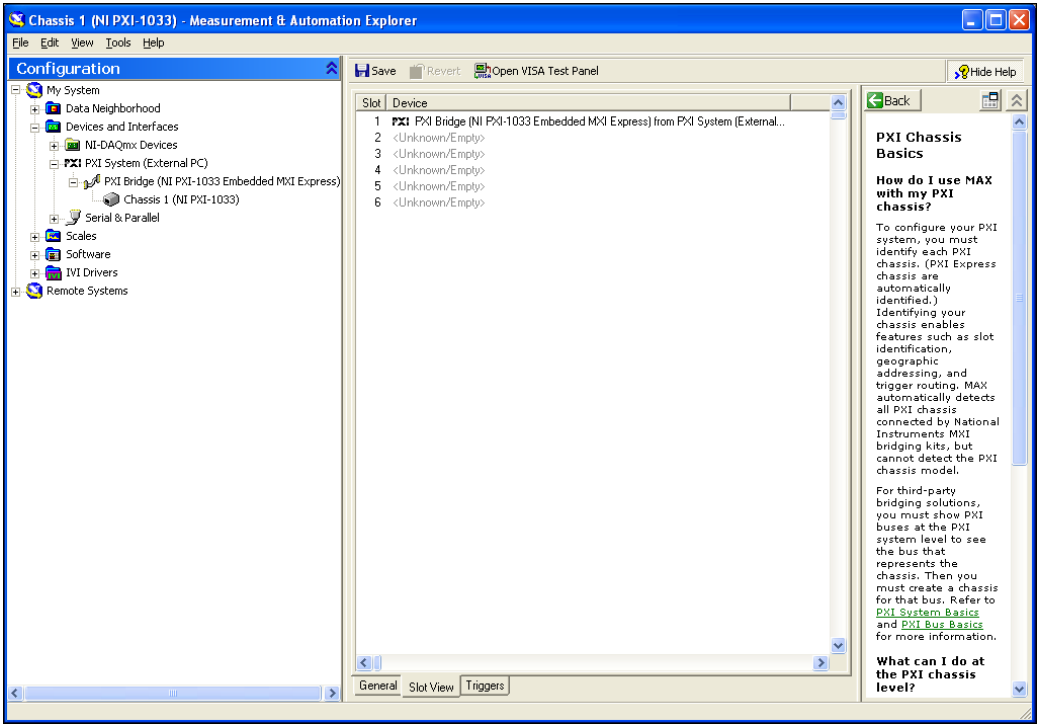

Chassis 1 (NI PXI-1033) - Measurement & Automation Explorer
File Edit View Tools Help
Configuration
My System
Data Neighborhood
Devices and Interfaces
NI-DAQmx Devices
PXI System (External PC)
PXI Bridge (NI PXI-1033 Embedded MXI Express)
Chassis 1 (NI PXI-1033)
Serial & Parallel
Scales
Software
IVI Drivers
Remote Systems
Save
Revert
Open VISA Test Panel
Hide Help
Slot
Device
1 PXI Bridge (NI PXI-1033 Embedded MXI Express) from PXI System (External...
2 <Unknown/Empty>
3 <Unknown/Empty>
4 <Unknown/Empty>
5 <Unknown/Empty>
6 <Unknown/Empty>
General
Slot View
Triggers
Back
PXI Chassis Basics
How do I use MAX with my PXI chassis?
To configure your PXI system, you must identify each PXI chassis. (PXI Express chassis are automatically identified.) Identifying your chassis enables features such as slot identification, geographic addressing, and trigger routing. MAX automatically detects all PXI chassis connected by National Instruments MXI bridging kits, but cannot detect the PXI chassis model.
For third-party bridging solutions, you must show PXI buses at the PXI system level to see the bus that represents the chassis. Then you must create a chassis for that bus. Refer to PXI System Basics and PXI Bus Basics for more information.
What can I do at the PXI chassis level?

Figure 2-6. Chassis Configuration in MAX

Basic PXI System Configuration

The *Platform Services* 2.1 (or higher) software provided on the NI Driver CD-ROM will automatically detect your NI PXI-1033 chassis. To manually configure your chassis follow the steps outlined below. Refer to Figure 2-6 while completing the following steps:

1. Launch MAX.
2. In the **Configuration** tree, click the **Devices and Interfaces** branch to expand it.
3. If the PXI system controller has not yet been configured, it will be labeled `PXI System (Unidentified)`. Right-click this entry to display the context menu and then select the appropriate controller model from the **Identify As** submenu.

4. Click the **PXI System** controller, and the chassis (or multiple chassis, in a multi-chassis configuration) will be listed below it. Identify each chassis by right-clicking its entry and then selecting **External PC** through the **Identify As** submenu. Further expanding the **PXI System** branch will show all of the devices in the system that can be recognized by NI-VISA. After your controller and all of your chassis have been identified, the required `pxisys.ini` file will be complete.
5. Apply the chassis number labels (shown in Figure 2-7) included with your kit to each chassis in your PXI system, and write in the chassis number accordingly in the white space.

Figure 2-7. Chassis Number Label

Trigger Configuration in MAX

Each chassis has one or more trigger buses, each with eight lines numbered 0 through 7 that can be reserved and routed statically or dynamically. Static reservation "pre-allocates" a trigger line to prevent its configuration by a user program. Dynamic reservation/routing/deallocation is performed *on the fly* within a user program based upon National Instruments APIs such as NI-DAQmx. Static reservation of trigger lines can be implemented by the user in MAX through the **Triggers** tab. Reserved trigger lines will not be used by PXI modules dynamically configured by programs such as NI-DAQmx. This prevents the instruments from double-driving the trigger lines, possibly damaging devices in the chassis.

Complete the following steps to reserve these trigger lines in MAX.

1. In the **Configuration** tree, click the PXI chassis branch you want to configure.
2. Click the **Triggers** tab at the bottom of the right-hand pane.
3. Select which trigger lines you want to statically reserve.
4. Click the **Apply** button.

Note For more information about routing and reserving PXI triggers refer to KnowledgeBase **3TJDOND8** at `ni.com/support`.

Using System Configuration and Initialization Files

The PXI specification allows many combinations of PXI chassis and system modules. To assist system integrators, the manufacturers of PXI chassis and system modules must document the capabilities of their products. The minimum documentation requirements are contained in `.ini` files, which consist of ASCII text. System integrators, configuration utilities, and device drivers can use these `.ini` files.

The capability documentation for the NI PXI-1033 chassis is contained in the `chassis.ini` file on the software media that comes with the chassis. The information in this file is combined with information about the system controller to create a single system initialization file called `pxisys.ini` (PXI System Initialization). The system controller manufacturer either provides a `pxisys.ini` file for the particular chassis model that contains the system controller or provides a utility that can read an arbitrary `chassis.ini` file and generate the corresponding `pxisys.ini` file. System controllers from National Instruments use MAX to generate the `pxisys.ini` file from the `chassis.ini` file.

Device drivers and other utility software read the `pxisys.ini` file to obtain system information. Device drivers should have no need to directly read the `chassis.ini` file. For detailed information regarding initialization files, refer to the PXI specification at `www.pxisa.org`.

3

Maintenance

This chapter describes basic maintenance procedures you can perform on the PXI-1033 chassis.

Caution Disconnect the power cables prior to servicing the chassis.

Service Interval

Clean the chassis fan filter at a maximum interval of six months. Depending on the amount of use and ambient dust levels in the operating environment, the filter may require more frequent cleaning.

Clean dust from the chassis exterior (and interior) as needed, based on the operating environment. Periodic cleaning increases reliability.

Preparation

The information in this chapter is designed for use by qualified service personnel. Read the *Read Me First: Safety and Radio-Frequency Interference* document included with your kit before attempting any procedures in this chapter.

Caution Many components within the chassis are susceptible to static discharge damage. Service the chassis only in a static-free environment. Observe standard handling precautions for static-sensitive devices while servicing the chassis. Always wear a grounded wrist strap or equivalent while servicing the chassis.

Cleaning

Caution *Always* disconnect the AC power cable before cleaning or servicing the chassis.

Cleaning procedures consist of exterior and interior cleaning of the chassis and cleaning the fan filter. Refer to your module user documentation for information on cleaning individual CompactPCI or PXI modules.

Interior Cleaning

Use a dry, low-velocity stream of air to clean the interior of the chassis. Use a soft-bristle brush for cleaning around components.

Exterior Cleaning

Cautions Avoid getting moisture inside the chassis during exterior cleaning, especially through the top vents. Use just enough moisture to dampen the cloth.

Do *not* wash the front- or rear-panel connectors or switches. Cover these components while cleaning the chassis.

Do *not* use harsh chemical cleaning agents; they may damage the chassis. Avoid chemicals that contain benzene, toluene, xylene, acetone, or similar solvents.

Clean the exterior surfaces of the chassis with a dry lint-free cloth or a soft-bristle brush. If any dirt remains, wipe with a cloth moistened in a mild soap solution. Remove any soap residue by wiping with a cloth moistened with clear water. Do *not* use abrasive compounds on any part of the chassis.

Cleaning and Replacing the Fan Filter

A dirty fan filter can dramatically reduce the cooling performance of the chassis. Clean the filter whenever it becomes visibly dirty. You can easily remove the chassis air filter from the bottom of the chassis by removing the filter cover. To remove the filter cover, loosen the retainer screw. The filter cover is shown in Figure 1-3, *Bottom View of the NI PXI-1033 Chassis*.

Clean the fan filter by washing it in a mild soap solution and then vacuuming or blowing air through it. Rinse the filter with water and allow it to dry before reinstalling it on the chassis.

You can replace the fan filter with part number 150139-C from Air Filtration Products, Inc., Tucson, AZ 85705, if necessary.

A

Specifications

Caution If the PXI-1033 chassis is used in a manner inconsistent with the instructions or specifications listed by National Instruments, the protective features of the chassis may be impaired.

Note Specifications are subject to change without notice.

This appendix contains specifications for the PXI-1033 chassis.

Electrical

AC Input

Input voltage range..... 100–240 VAC

Operating voltage range[1]..... 90–264 VAC

Input frequency ..... 50/60 Hz

Operating frequency range[1] ..... 47–63 Hz

Input current rating..... 4–2 A

Efficiency ..... >70% at full load, normal input voltage

Power disconnect ..... The AC power cable provides main power disconnect. The front-panel power switch controls the internal chassis power supply that provides DC power to the CompactPCI/PXI backplane.

[1] The operating range is guaranteed by design.

DC Output

DC current capacity (I_{MP})

Voltage	0–50 °C
+3.3 V	10 A
+5 V	15 A
+12 V	2.5 A
–12 V	0.8 A

Over-current protection .....All outputs protected from short circuit

Over-voltage protection

Over-voltage at	Active Range	
	Minimum	Maximum
+3.3 V	3.76 V	4.3 V
+5 V	5.74 V	7.0 V
+12 V	13.4 V	15.6 V

Chassis Cooling

Per slot cooling capacity.....25 W

Slot airflow direction .....P1 to P2, bottom of module to top of module

Module cooling

- System .....Forced air circulation (positive pressurization) through a High Flow fan with HIGH/AUTO speed selector
- Intake .....Bottom of chassis
- Exhaust .....Along rear, right side, and top of chassis

Power supply cooling

- System .....Forced air circulation through integrated fan

Intake ..... Front side of chassis
Exhaust..... Rear side of chassis

Environmental

Maximum altitude ..... 2,000 m (800 mbar) (at 25 °C ambient)

Measurement Category II

Pollution Degree 2

For indoor use only.

Operating Environment

Ambient temperature range..... 0 to 50 °C (Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2. Meets MIL-PRF-28800F Class 3 low temperature limit and high temperature limit.)

Relative humidity range ..... 20 to 80%, noncondensing (Tested in accordance with IEC-60068-2-56.)

Storage Environment

Ambient temperature range..... –40 to 85 °C (Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2. Meets MIL-PRF-28800F Class 3 limits.)

Relative humidity range ..... 10 to 95%, noncondensing (Tested in accordance with IEC-60068-2-56.)

Shock and Vibration

Operational shock ..... 20 g peak, half-sine, 11 ms pulse (Tested in accordance with IEC-60068-2-27. Meets MIL-PRF-28800F Class 2 limits.)

Random Vibration

Operating .....5 to 500 Hz, 0.3 g_{rms}

Nonoperating .....5 to 500 Hz, 2.4 g_{rms}
(Tested in accordance with IEC-60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)

Acoustic Emissions

Sound Pressure Level (at Operator Position)

(Tested in accordance with ISO 7779. Meets MIL-PRF-28800F requirements.)

PXI-1033

Auto fan (at 25 °C ambient) .....37.4 dBA

High fan .....51.5 dBA

Sound Power

(Tested in accordance with ISO 7779.)

PXI-1033

Auto fan (at 25 °C ambient) .....43.8 dBA

High fan .....60.9 dBA

Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- EN 61010-1, IEC 61010-1
- UL 61010-1, CAN/CSA-C22.2 No. 61010-1

Note For UL and other safety certifications, refer to the product label, or visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

Electromagnetic Compatibility

This product is designed to meet the requirements of the following standards of EMC for electrical equipment for measurement, control, and laboratory use:

- EN 61326 EMC requirements; Minimum Immunity
- EN 55011 Emissions; Group 1, Class A
- CE, C-Tick, ICES, and FCC Part 15 Emissions; Class A

Note For EMC compliance, operate this device according to printed documentation.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- 73/23/EEC; Low-Voltage Directive (safety)
- 89/336/EEC; Electromagnetic Compatibility Directive (EMC)

Note Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of their life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit `ni.com/environment/weee.htm`.

Backplane

Size	3U-sized; integrated controller and 5 peripheral slots. Compliant with IEEE 1101.10 mechanical packaging. *PXI Hardware Specification, Revision 2.2* compliant. Accepts both PXI and CompactPCI 3U modules.
V(I/O)[1]	+5 V

Backplane bare-board material .....UL 94 V-0 recognized

Backplane connectors .....Conform to IEC 917 and IEC 1076-4-101, and are UL 94 V-0 rated

10 MHz System Reference Clock (10 MHz REF)

Maximum clock skew between slots.....250 ps

Built-in 10 MHz clock

Accuracy.....±25 ppm (guaranteed over the operating temperature range)

Mechanical

Overall dimensions (standard chassis)

Height .....177 mm (6.97 in.)

Note 12.7 mm (0.50 in.) is added to height when feet are installed.

Width .....257.1 mm (10.12 in.)

Depth .....212.8 mm (8.38 in.)

Weight .....5 kg (11.0 lbs)

Chassis materials .....Sheet Aluminum, Extruded Aluminum, Cold Rolled Steel, Nylon

Finish .....Clear Chromate Conversion Coat on Aluminum
Electrodeposited Nickel Plate Plate on Cold Rolled Steel
Polyester Urethane Powder Paint

[1] V(I/O) is connected to the +5 V DC power plane, so the same specifications apply to V(I/O) and +5 V.

Figure A-1 and Figure A-2 show the PXI-1033 dimensions. The holes shown are for the installation of the optional rack-mount kits as shown in Figure A-3. Notice that the front and rear rack mounting holes (size M4) are symmetrical.

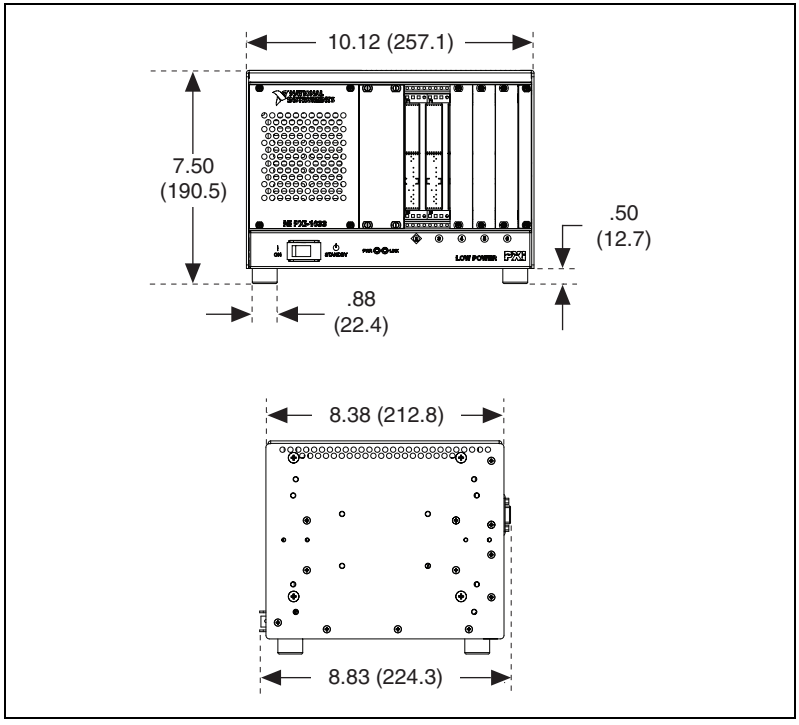


Figure A-1. PXI-1033 Dimensions (Front and Side) in Inches (mm)

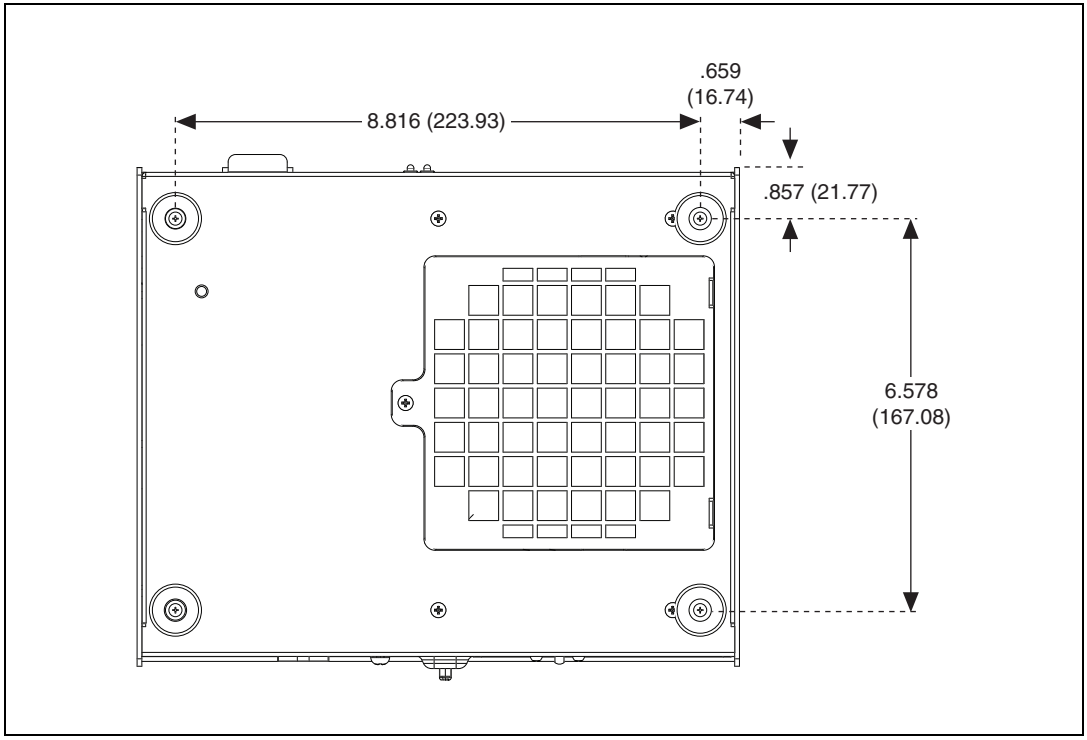
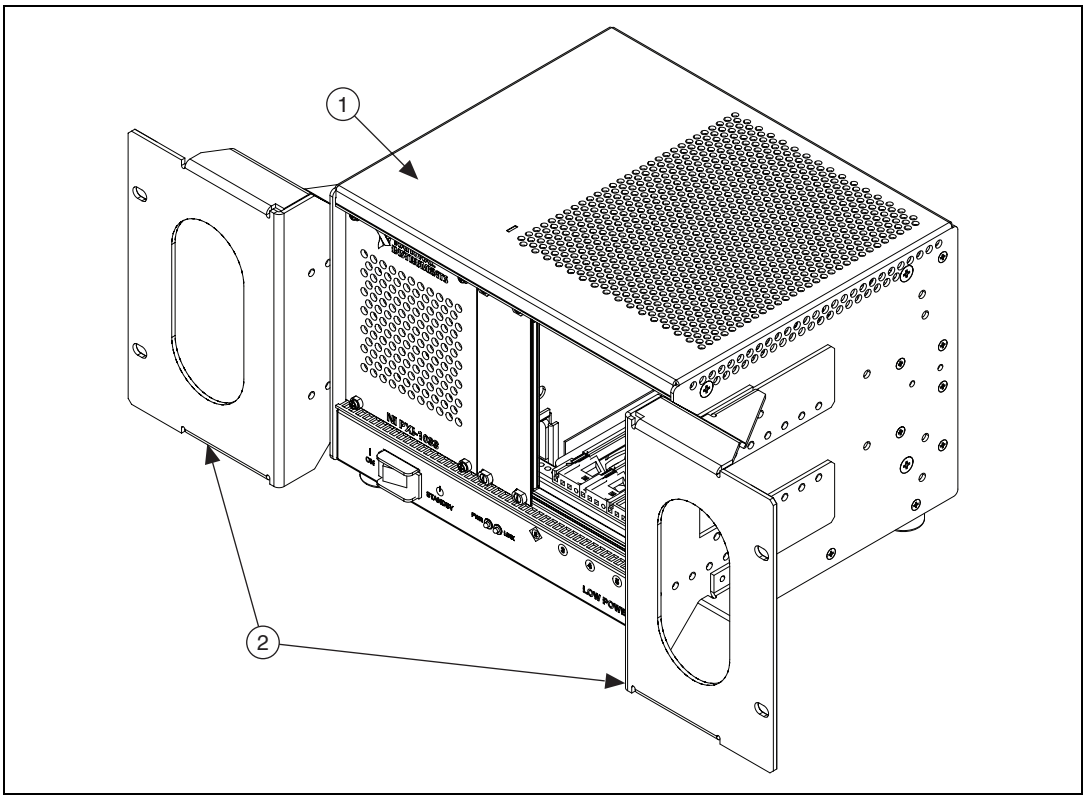


Figure A-2. PXI-1033 Dimensions (Bottom) in Inches (mm)

Figure A-3 shows the PXI-1033 rack mount kit components.



1 PXI-1033 Chassis	2 Rack Mount Kit

Figure A-3. PXI-1033 Rack Mount Kit Components

B

Pinouts

This appendix describes the P1 and P2 connector pinouts for the PXI-1033/PXI-1033 backplane.

Table B-1 shows the P1 (J1) connector pinout for the star trigger slot.

Table B-2 shows the P2 (J2) connector pinout for the star trigger slot.

Table B-3 shows the P1 (J1) connector pinout for the peripheral slots.

Table B-4 shows the P2 (J2) connector pinout for the peripheral slots.

Note PXI signals are shown in bold.

Table B-1. P1 (J1) Connector Pinout for the Star Trigger Slot

Pin	Z	A	B	C	D	E	F
25	GND	5V	REQ64#	ENUM#	3.3V	5V	GND
24	GND	AD[1]	5V	V(I/O)	AD[0]	ACK64#	GND
23	GND	3.3V	AD[4]	AD[3]	5V	AD[2]	GND
22	GND	AD[7]	GND	3.3V	AD[6]	AD[5]	GND
21	GND	3.3V	AD[9]	AD[8]	M66EN	C/BE[0]#	GND
20	GND	AD[12]	GND	V(I/O)	AD[11]	AD[10]	GND
19	GND	3.3V	AD[15]	AD[14]	GND	AD[13]	GND
18	GND	SERR#	GND	3.3V	PAR	C/BE[1]#	GND
17	GND	3.3V	IPMB_SCL	IPMB_SDA	GND	PERR#	GND
16	GND	DEVSEL#	GND	V(I/O)	STOP#	LOCK#	GND
15	GND	3.3V	FRAME#	IRDY#	BD_SEL#	TRDY#	GND
12–14	Key Area						
11	GND	AD[18]	AD[17]	AD[16]	GND	C/BE[2]#	GND
10	GND	AD[21]	GND	3.3V	AD[20]	AD[19]	GND
9	GND	C/BE[3]#	IDSEL	AD[23]	GND	AD[22]	GND
8	GND	AD[26]	GND	V(I/O)	AD[25]	AD[24]	GND
7	GND	AD[30]	AD[29]	AD[28]	GND	AD[27]	GND
6	GND	REQ#	GND	3.3V	CLK	AD[31]	GND
5	GND	BRSVP1A5	BRSVP1B5	RST#	GND	GNT#	GND
4	GND	IPMB_PWR	HEALTHY#	V(I/O)	INTP	INTS	GND
3	GND	INTA#	INTB#	INTC#	5V	INTD#	GND
2	GND	TCK	5V	TMS	TDO	TDI	GND
1	GND	5V	–12V	TRST#	+12V	5V	GND

Table B-2. P2 (J2) Connector Pinout for the Star Trigger Slot

Pin	Z	A	B	C	D	E	F
22	GND	GA4	GA3	GA2	GA1	GA0	GND
21	GND	**PXI_LBR0**	RSV	**PXI_LBR1**	**PXI_LBR2**	**PXI_LBR3**	GND
20	GND	**PXI_LBR4**	**PXI_LBR5**	**PXI_STAR0**	GND	**PXI_STAR1**	GND
19	GND	**PXI_STAR2**	RSV	**PXI_STAR3**	**PXI_STAR4**	**PXI_STAR5**	GND
18	GND	**PXI_TRIG3**	**PXI_TRIG4**	**PXI_TRIG5**	GND	**PXI_TRIG6**	GND
17	GND	**PXI_TRIG2**	GND	RSV	**PXI_CLK10_IN**	**PXI_CLK10**	GND
16	GND	**PXI_TRIG1**	**PXI_TRIG0**	RSV	GND	**PXI_TRIG7**	GND
15	GND	**PXI_BRSVA15**	GND	RSV	**PXI_STAR6**	**PXI_LBR6**	GND
14	GND	RSV	RSV	RSV	GND	RSV	GND
13	GND	RSV	GND	V(I/O)	RSV	RSV	GND
12	GND	RSV	RSV	RSV	GND	RSV	GND
11	GND	RSV	GND	V(I/O)	RSV	RSV	GND
10	GND	RSV	RSV	RSV	GND	RSV	GND
9	GND	RSV	GND	V(I/O)	RSV	RSV	GND
8	GND	RSV	RSV	RSV	GND	RSV	GND
7	GND	RSV	GND	V(I/O)	RSV	RSV	GND
6	GND	RSV	RSV	RSV	GND	RSV	GND
5	GND	RSV	GND	V(I/O)	RSV	RSV	GND
4	GND	V(I/O)	**PXI_BRSVB4**	RSV	GND	RSV	GND
3	GND	**PXI_LBR7**	GND	**PXI_LBR8**	**PXI_LBR9**	**PXI_LBR10**	GND
2	GND	**PXI_LBR11**	**PXI_LBR12**	UNC	**PXI_STAR7**	**PXI_STAR8**	GND
1	GND	**PXI_STAR9**	GND	**PXI_STAR10**	**PXI_STAR11**	**PXI_STAR12**	GND

Table B-3. P1 (J1) Connector Pinout for the Generic Peripheral Slot

Pin	Z	A	B	C	D	E	F
25	GND	5V	REQ64#	ENUM#	3.3V	5V	GND
24	GND	AD[1]	5V	V(I/O)	AD[0]	ACK64#	GND
23	GND	3.3V	AD[4]	AD[3]	5V	AD[2]	GND
22	GND	AD[7]	GND	3.3V	AD[6]	AD[5]	GND
21	GND	3.3V	AD[9]	AD[8]	M66EN	C/BE[0]#	GND
20	GND	AD[12]	GND	V(I/O)	AD[11]	AD[10]	GND
19	GND	3.3V	AD[15]	AD[14]	GND	AD[13]	GND
18	GND	SERR#	GND	3.3V	PAR	C/BE[1]#	GND
17	GND	3.3V	IPMB_SCL	IPMB_SDA	GND	PERR#	GND
16	GND	DEVSEL#	GND	V(I/O)	STOP#	LOCK#	GND
15	GND	3.3V	FRAME#	IRDY#	BD_SEL#	TRDY#	GND
12–14	Key Area						
11	GND	AD[18]	AD[17]	AD[16]	GND	C/BE[2]#	GND
10	GND	AD[21]	GND	3.3V	AD[20]	AD[19]	GND
9	GND	C/BE[3]#	IDSEL	AD[23]	GND	AD[22]	GND
8	GND	AD[26]	GND	V(I/O)	AD[25]	AD[24]	GND
7	GND	AD[30]	AD[29]	AD[28]	GND	AD[27]	GND
6	GND	REQ#	GND	3.3V	CLK	AD[31]	GND
5	GND	BRSVP1A5	BRSVP1B5	RST#	GND	GNT#	GND
4	GND	IPMB_PWR	HEALTHY#	V(I/O)	INTP	INTS	GND
3	GND	INTA#	INTB#	INTC#	5V	INTD#	GND
2	GND	TCK	5V	TMS	TDO	TDI	GND
1	GND	5V	–12V	TRST#	+12V	5V	GND

Table B-4. P2 (J2) Connector Pinout for the Generic Peripheral Slot

Pin	Z	A	B	C	D	E	F
22	GND	GA4	GA3	GA2	GA1	GA0	GND
21	GND	**PXI_LBR0**	RSV	**PXI_LBR1**	**PXI_LBR2**	**PXI_LBR3**	GND
20	GND	**PXI_LBR4**	**PXI_LBR5**	**PXI_LBL0**	GND	**PXI_LBL1**	GND
19	GND	**PXI_LBL2**	RSV	**PXI_LBL3**	**PXI_LBL4**	**PXI_LBL5**	GND
18	GND	**PXI_TRIG3**	**PXI_TRIG4**	**PXI_TRIG5**	GND	**PXI_TRIG6**	GND
17	GND	**PXI_TRIG2**	GND	RSV	**PXI_STAR**	**PXI_CLK10**	GND
16	GND	**PXI_TRIG1**	**PXI_TRIG0**	RSV	GND	**PXI_TRIG7**	GND
15	GND	**PXI_BRSVA15**	GND	RSV	**PXI_LBL6**	**PXI_LBR6**	GND
14	GND	RSV	RSV	RSV	GND	RSV	GND
13	GND	RSV	GND	V(I/O)	RSV	RSV	GND
12	GND	RSV	RSV	RSV	GND	RSV	GND
11	GND	RSV	GND	V(I/O)	RSV	RSV	GND
10	GND	RSV	RSV	RSV	GND	RSV	GND
9	GND	RSV	GND	V(I/O)	RSV	RSV	GND
8	GND	RSV	RSV	RSV	GND	RSV	GND
7	GND	RSV	GND	V(I/O)	RSV	RSV	GND
6	GND	RSV	RSV	RSV	GND	RSV	GND
5	GND	RSV	GND	V(I/O)	RSV	RSV	GND
4	GND	V(I/O)	64EN#	RSV	GND	RSV	GND
3	GND	**PXI_LBR7**	GND	**PXI_LBR8**	**PXI_LBR9**	**PXI_LBR10**	GND
2	GND	**PXI_LBR11**	**PXI_LBR12**	UNC	**PXI_LBL7**	**PXI_LBL8**	GND
1	GND	**PXI_LBL9**	GND	**PXI_LBL10**	**PXI_LBL11**	**PXI_LBL12**	GND

C

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Glossary

Symbol	Prefix	Value
p	pico	10^{-12}
n	nano	10^{-9}
µ	micro	10^{-6}
m	milli	10^{-3}
k	kilo	10^{3}
M	mega	10^{6}
G	giga	10^{9}
T	tera	10^{12}

Symbols

°	Degrees
≥	Equal or greater than
≤	Equal or less than
%	Percent
Ω	Ohms

A

A	Amperes
AC	Alternating current
ANSI	American National Standards Institute
AUTO	Automatic fan speed control
AWG	American Wire Gauge

B

backplane	An assembly, typically a printed circuit board, with connectors and signal paths that bus the connector pins

C

C	Celsius
cfm	Cubic feet per minute
CFR	Code of Federal Regulations
cm	Centimeters
CompactPCI	An adaptation of the Peripheral Component Interconnect (PCI) Specification 2.1 or later for industrial and/or embedded applications requiring a more robust mechanical form factor than desktop PCI. It uses industry standard mechanical components and high-performance connector technologies to provide an optimized system intended for rugged applications. It is electrically compatible with the PCI Specification, which enables low-cost PCI components to be utilized in a mechanical form factor suited for rugged environments.
CSA	Canadian Standards Association

D

daisy-chain	A method of propagating signals along a bus, in which the devices are prioritized on the basis of their position on the bus
DC	Direct current
DoC	Declaration of Conformity

E

efficiency	Ratio of output power to input power, expressed as a percentage
EIA	Electronic Industries Association

embedded system controller	A module configured for installation in slot 1 of a PXI chassis. This device is unique in the PXI system in that it performs the system controller functions, including clock sourcing and arbitration for data transfers across the backplane. Installing such a device into any other slot can damage the device, the PXI backplane, or both.
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference

F

FCC	Federal Communications Commission
filler panel	A blank module front panel used to fill empty slots in the chassis

G

g	(1) grams; (2) a measure of acceleration approximately equal to 9.8 m/s^2
GPIB	General Purpose Interface Bus (IEEE 488)
g_{rms}	A measure of random vibration; the root mean square of acceleration levels in a random vibration test profile

H

hr	Hours
Hz	Hertz—Cycles per second

I

IEC	International Electrotechnical Commission—An organization that sets international electrical and electronics standards.
IEEE	Institute of Electrical and Electronics Engineers
I_{MP}	Mainframe peak current

in.	Inches
inhibit	To turn off

J

jitter	A measure of the small, rapid variations in clock transition times from their nominal regular intervals. Units: seconds RMS

K

kg	Kilograms
km	Kilometers

L

lb	Pounds
load regulation	The maximum steady-state percentage that a DC voltage output will change as a result of a step change from no-load to full-load output current

M

m	Meters
MAX	NI Measurement & Automation Explorer, the utility that allows you to configure and test your PXI system
MHz	Megahertz—One million Hertz; one Hertz equals one cycle per second.
ms	Millisecond—One thousandth of a second (10^{-3}).

N

NEMA	National Electrical Manufacturers Association
NI	National Instruments

NI-DAQmx	National Instruments driver that controls the operation of National Instruments data acquisition (DAQ) devices
NI-VISA	National Instruments implementation of the VISA (Virtual Instrument System Architecture) I/O standard. NI-VISA provides support for the VISA API, and also provides VISAIC, a utility for instrument configuration and I/O function execution.
ns	Nanosecond—One billionth of a second (10^{-9}).

P

ppm	Parts-per-million
PXI	PCI eXtensions for Instrumentation. PXI is an implementation of CompactPCI with added electrical features that meet the high performance requirements of instrumentation applications by providing triggering, local buses, and system clock capabilities.
PXI_CLK10	10 MHz PXI system reference clock

R

RMS	Root mean square

S

s	Seconds
skew	Deviation in signal transmission times
slot blocker	An assembly installed into an empty slot to improve the airflow in adjacent slots
ST	Star trigger
standby	The backplane is unpowered (off), but the chassis is still connected to AC power mains

star trigger slot	This slot is located at slot 2 and has a dedicated trigger line between each peripheral slot. Use this slot for a module with ST functionality that can provide individual triggers to all other peripherals.
system reference clock	A 10 MHz clock, also called PXI_CLK10, that is distributed to all peripheral slots in the chassis. The system reference clock can be used for synchronization of multiple modules in a measurement or control system. The PXI backplane specification defines implementation guidelines for PXI_CLK10.

T

TTL	Transistor-transistor logic

U

UL	Underwriter's Laboratories

V

V	Volts
VAC	Volts alternating current, or V_{rms}
V_{pp}	Peak-to-peak voltage

W

W	Watts

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